

1 **DIGITAL CAMERA WITH MULTI-ILLUMINATING SOURCE**

2 BACKGROUND OF THE INVENTION

3 1. Field of the Invention

4 The present invention relates to a digital camera with a multi-illuminating
5 source, and more particularly to a digital camera that not only has a flash light
6 illuminating source, but also has an infrared illuminating source.

7 2. Description of Related Art

8 Due to the developing technology of digital cameras, there is a tendency
9 that the digital camera is gradually becoming as common as the conventional
10 camera. The photograph taken by the digital camera is stored as a digital photo
11 file, thus the digital photo file is suitable for use in many fields. The digital
12 photo file is often transferred to clothes and printed on many objects, such as
13 cups, keepsakes etc. Furthermore, one of the advantages of the digital camera is
14 that the digital photo file is able to be stored in a computer, so all photos can be
15 compactly and pristinely kept for eternity.

16 Conventionally, the digital camera only has a single illuminating light
17 source for use in low light during the day. When the flash lamp light is used, the
18 digital camera is only suitable for a specific illuminating condition.

19 To overcome the shortcomings, the present invention tends to provide a
20 digital camera with a multi-illuminating source to mitigate and obviate the
21 aforementioned problems.

22 SUMMARY OF THE INVENTION

23 The main objective of the invention tends to provide a digital camera with a
24 multi-illuminating source, wherein the digital camera has an infrared

1 illuminating source for use in an insufficient light situation, such as at night, and
2 a flash lamp light source for use in a low light situation, such as a cloudy day.

3 Other objects, advantages and novel features of the invention will become
4 more apparent from the following detailed description when taken in
5 conjunction with the accompanying drawings.

6 BRIEF DESCRIPTION OF THE DRAWINGS

7 Fig. 1 is a block diagram of a digital camera in accordance with the present
8 invention;

9 Fig.2 shows timing control signals of a CCD sensor, and a flash lamp light
10 signal in accordance with the present invention;

11 Fig.3 shows timing control signals of a CCD sensor, and a laser light signal
12 in accordance with the present invention; and

13 Fig.4 is a graph of transmittance versus wavelength for a filter shown in Fig.
14 1 in accordance with the present invention.

15 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

16 With regards to Figs. 1 and 2, a digital camera in accordance with the
17 present invention comprises a microprocessor (10) connected to a flash lamp
18 driver (20), a laser driver (30) and a charge coupled device (CCD) sensor (40).
19 The CCD sensor (40) is further connected with a filter (42) and a memory (50).
20 The flash lamp driver (20) and the laser driver (30) are respectively connected
21 with a flash lamp (22) and an infrared laser diode (32) (IR LD).

22 The digital camera disclosed in this application is able to be operated in two
23 modes, a flash lamp illuminating mode and an infrared illuminating mode.

24 When the surrounding light is insufficient such as at night, the digital camera is

operated in the infrared illuminating mode. On the contrary, the digital camera is operated in the flash lamp illuminating mode during daytime. The detailed operation of the two modes mentioned is in the following description.

When the digital camera is operated in the flash lamp illuminating mode, the microprocessor (10) provides a trigger signal to the flash lamp driver (20), whereby the flash lamp driver (20) controls the flash lamp (22) to generate a flashlight signal toward a target. After the flashlight signal is reflected from the target, and passes through a first lens (60) and a filter (42), the reflected optical signal is converted into a digital photo signal by the CCD sensor (40) and then stored in the memory (50). The filter (42) is treated specially for receiving the visible reflected optical signal from the target with a wavelength under 700nm.

With reference to Fig. 2, in the flash lamp illuminating light mode, the period from T1 to T2 indicated with (A) represents a sensing period of the CCD sensor (40), and the period from T1 to T3 indicated with (B) represents the period of the flashlight signal emitted by the flash lamp (22). Since a time delay exists between emitting the flashlight signal and receiving the reflected flashlight signal, the sensing period T1 to T2 is purposely designed to be a little longer than the period T1 to T3, whereby the CCD sensor (40) has enough time to convert the optical signal into the digital signal.

With reference to Fig. 1, when the digital camera is operated in the infrared illuminating mode, the microprocessor (10) provides a trigger signal to the laser driver (30), whereby the laser driver (30) controls the infrared laser diode (32) to generate a series of infrared light pulse signals with accurate time toward a target through a second lens (61). After the infrared light pulses are immediately

1 reflected from the target, and pass through the first lens (60) and the filter (42),
2 the reflected infrared light signals are converted into a digital photo signal by the
3 CCD sensor (40) and then stored in the memory (50). The filter (42) also can
4 receive the infrared signal with 890nm wavelength. Furthermore in this
5 invention, the infrared laser diode (32) is able to be replaced by an infrared light
6 emitting diode (IR LED).

7 With reference to Fig. 3, in the infrared illuminating mode, the signal (A)
8 represents the sensing period of the CCD sensor (40), and the signal (B)
9 represents the emitted infrared light pulse signal. Because the speed of the
10 infrared light signal is very fast, i.e., almost no time delay, the sensing period of
11 the CCD sensor (40) is synchronized to the emitted infrared light signal.

12 With reference to Fig. 4, the characteristic chart of the filter (42) is shown.
13 The filter (42) is treated specially for receiving visual light with a wavelength
14 under 700nm and invisible infrared light with a wavelength 890nm. The light
15 signals with wavelengths other than 890nm and under 700nm are obstructed by
16 the filter (42).

17 Although the present invention has been explained in relation to its
18 preferred embodiment, it is to be understood that many other possible
19 modifications and variations can be made without departing from the spirit and
20 scope of the invention as hereinafter claimed.